

AMENDMENTS TO THE CLAIMS

1. (Cancelled)

2. (Cancelled)

3. (Cancelled)

4. (Cancelled)

5. (Cancelled)

6. (Cancelled)

7. (Cancelled)

8. (Cancelled)

9. (Cancelled)

10. (Cancelled)

11. (Cancelled)

12. (Cancelled)

13. (Currently Amended): A microelectronic sensor system comprising:

at least one separation channel,
at least one interferometer, said interferometer including an arm and an
integrated chip, wherein said separation channel and said interferometer arm
orthogonally intersect each other at least once on said integrated chip,
at least one modulated excitation beam having a wavelength,
at least one light source,
at least one photo receiver,
a lock-in amplifier, ~~The microelectronic sensor system of claim 12, further~~
~~comprising:~~

a probe laser,
a polarization-maintaining fiber used to couple all components,
an integrated optical circuit having two phase modulators and
a Mach-Zehnder interferometer.

14. (Original): The microelectronic sensor system of claim 13, wherein said probe laser is a superluminescent diode supplying 1 mW continuous wave at a center wavelength of 1315 nm with a full-width, half-maximum of 46 nm, said Mach-Zehnder interferometer has an optical path distance between about 585.5 μm and about 589.5 μm , one of said phase modulators produces a phase shift of about 200° at a current of 100 mA, and the other of said phase modulators produces a phase shift of about 500 at a current of about 100 mA.

15. (Cancelled)

16. (Cancelled)

17. (Cancelled)

18. (Cancelled)

19. (Cancelled)

20. (Cancelled)

21. (Cancelled)

22. (Cancelled)

23. (Cancelled)

24. (Cancelled)

25. (Currently Amended): A microelectronic sensor system comprising:
at least one separation channel,
at least one interferometer, said interferometer including an arm and an
integrated chip, wherein said separation channel and said interferometer arm
orthogonally intersect each other at least once on said integrated chip,
at least one modulated excitation beam having a wavelength,
at least one light source, and
at least one photo receiver, and wherein

~~The microelectronic sensor system of claim 1,~~ said interferometer ~~having~~ has a sample arm and a reference arm, said separation channel ~~having~~ has a first end port, a second end port and an exit port located approximately in the center of the separation channel, wherein said sample arm orthogonally intersects said separation channel at a

sample position located between said first end port and said exit port and said reference arm orthogonally intersects said separation channel at a reference position located between said second end port and said exit port.

26. (Original): The microelectronic sensor system of claim 25, further comprising:
a beamsplitter, wherein said beamsplitter divides light from said modulated excitation beam into at least two approximately equal beams, producing a first excitation beam and a second excitation beam, wherein said first excitation beam passes through said separation channel at said sample position and said second excitation beam passes through said separation channel at said reference position.

27. (Cancelled)

28. (Previously Presented): An integrated sensor system device, comprising:
a separation capillary embedded inside of a solid material substrate such as glass,
a laser excitation source,
a chopping device to modulate said excitation source,
a beam splitter that divides light from said chopped excitation source into at least two approximately equal beams,
a buffer solution,
an analyte dissolved in said buffer solution,
a multiplicity of end ports into said capillary being respectively located at the two ends of and in the approximate center along the length of said capillary, with said analyte dissolved in a buffer solution being introduced into said capillary through the first of said end ports, and said buffer solution without analyte being introduced into

said capillary through the second of said end ports and all of said fluids exiting through said center port,

three electrodes deposited upon said substrate and immersed in said fluids in said ports,

high-voltage direct-current power supplies interconnected between said electrodes,

an interferometer comprising an integrated chip formed from optical waveguides embedded inside of said solid material substrate, said interferometer having a first arm and a second arm, with said first arm operatively intersecting said separation capillary and said first beam of laser excitation source at a location between said first end port and said center port, and said second arm operatively intersecting said separation capillary and said second beam of laser excitation source at a location between said second end port and said center port, and

an optical instrument that measures the interferometric state of said interferometer.

29. (Previously Presented): A sensor system, comprising:

a separation capillary,

a laser excitation source,

a chopping device to modulate said excitation source,

a beam splitter that divides light from said chopped excitation source into two approximately equal beams,

a buffer solution,

an analyte dissolved in said buffer solution,

three ports into said capillary being respectively located at the two ends of and in the approximate center along the length of said capillary, with said analyte dissolved in a buffer solution being introduced into said capillary through the first of said end ports,

and said buffer solution without analyte being introduced into said capillary through the second of said end ports, and all of said fluids exiting through said center port, three electrodes immersed in said fluids in said ports, several high-voltage direct-current power supplies interconnected between said electrodes,

an interferometer comprising an integrated chip, said interferometer having a first arm and a second arm, with said first arm operatively intersecting said separation capillary and said first beam of laser excitation source at a location between said first end port and said center port, and said second arm operatively intersecting said separation capillary and said second beam of laser excitation source at a location between said second end port and said center port, and

an optical instrument that measures the interferometric state of said interferometer.

30. (Cancelled)

31. (Currently Amended): A micro-analytical method of analyzing an analyte, comprising the steps of:

providing an interferometer that comprises an integrated chip, said interferometer having an interferometer arm position over a separation channel, wherein said separation channel and said interferometer arm orthogonally intersect each other at least once on said integrated chip,

delivering a modulated excitation beam to a separation channel having a first end port and an exit port,

introducing an analyte into the first end port of said separation channel such that the analyte travels in the direction from said first end port to said exit port,

measuring the change in the index of refraction of light versus time at a sample position located between said first end port and said exit port in the separation channel using an interferometer, and ~~The micro-analytical method of claim 30,~~

further comprising ~~the steps of:~~ dissolving said analyte in a reference material before introduction into said separation channel,

introducing a reference material into a second end port of said separation channel, such that the reference material travels in the direction from said second end port to said exit port creating a time-varying index of refraction along said separation channel, and

measuring the change in the index of refraction of light versus time at a reference position between said second end port and said exit port in the separation channel using an interferometer.

32. (Original): The micro-analytical method of claim 30, further comprising the steps of:

vaporizing said analyte in a carrier gas before introduction into said separation channel,

introducing said carrier gas into a second end port of said separation channel, such that the carrier gas travels in the direction from said second end port to said exit port creating a time-varying index of refraction along said separation channel,

measuring the change in the index of refraction of light versus time at a reference position between said second end port and said exit port in the separation channel using an interferometer.

33. (Previously Presented): A method of analyzing an analyte, comprising the steps of:

providing an interferometer that comprises an integrated chip, said interferometer having an interferometer arm position over a separation channel, wherein said separation channel and said interferometer arm orthogonally intersect each other at least once on said integrated chip,

delivering a modulated excitation beam to said separation channel having a first end, a second end port and an exit port approximately in the center of said separation channel, wherein said excitation beam is split into two approximately equal optical excitation beams, wherein one of said optical excitation beams intersects the separation channel at a sample position located between said first end port and said exit port and the other optical excitation beam intersects the separation channel at a reference position located between said second end port and said exit port,

introducing an analyte in a reference material into said first end port of the separation channel, such that the analyte travels in the direction from said first end port to said exit port,

introducing pure reference material into said second end port of the separation channel, such that the reference material travels in the direction from said second end port to said exit port,

measuring the change in the index of refraction of light versus time at a sample position between said first end port and said exit port in the separation channel and the change in the index of refraction of light versus time at a reference position between said second end port and said exit port in the separation channel using an interferometer with a first interferometer arm orthogonally intersecting the separation channel at said sample position and a second interferometer arm orthogonally intersecting the separation channel at said reference position,

demodulating said time-varying index of refraction with a lock-in amplifier synchronized to said optical excitation beams, and

recording the time history of said demodulated index of refraction.

34. (Original): The method of claim 33, further comprising the step of:
measuring the transit time of said analyte through said separation channel by
observing the time of arrival of said time history data thus providing a temporal
signature for the analyte.

35. (Original): The method of claim 34, wherein said separation channel is an
electrophoresis capillary, further comprising the step of:
applying high voltage to said separation channel thus causing said analyte and
reference material to flow toward and out of the exit port by electro-osmotic flow and
with electrophoretic separation occurring.